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AUTHOR Renner, John W.
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ABSTRACT

This research investigated the value students attached to the laboratory activities while studying physics using the learning cycle curriculum construction and teaching procedures. Among the procedures used to supply students laboratory data were video-taped demonstrations, "live" teacher demonstration, presenting data in written form someone else had gathered, being lectured to about the data, or taking data from a textbook. Before each learning cycle began and after each learning cycle phase (a total of four times) six students were interviewed to determine their knowledge of content, how their understandings of physics were changing, and their feelings regarding the laboratory activities being used. Approximately 150 such interviews were conducted. The naturalistic data from the interviews (samples of which are provided) demonstrate that students are enthusiastic about what and how they learn in the laboratory. They believe that learning in the laboratory is superior to other procedures used to supply them data. This suggests that the laboratory is essential if physics is to be experienced as science. (JN)

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Student Opinions of the Laboratory Activities in the Learning Cycle in Secondary School Physics

John W. Renner
Professor of Science Education
Adjunct Professor of Physics
University of Oklahoma

The research upon which the proposed presentation will be based was done to ascertain the value that students attached to the laboratory activities while studying physics using the learning cycle curriculum construction and teaching procedures. Several procedures were used to supply them laboratory data during the research. Among those procedures were video-taped teacher demonstrations, "live" teacher demonstrations, presenting data in a written form someone else had gathered, being lectured to about the data, or taking data from a textbook.

During a complete academic year, seven investigations were made into teaching physics with the learning-cycle model. The complete physics course had been prepared using the learning cycle as a curriculum model. When an investigation into the teaching of physics was conducted, therefore, the classroom activities were not novel to the students. Before a learning cycle began and after each phase--a total of four times--six students were interviewed regarding their knowledge of content, to determine how their understandings of physics were changing and to ascertain their feelings regarding the laboratory activities being used. Approximately 150 such interviews were conducted. Those interviews furnished the data used in ascertaining the students' attitudes toward the function of the laboratory in the learning cycle.

All interviews were conducted in a private room and were audio-recorded with the students' knowledge and permission and the permission of the parents or guardians. The audio tapes were analyzed and the sections of them containing data relative to the value students attached to the laboratory were transcribed. Those transcriptions were then analyzed by several members of the research team. The

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naturalistic data which follow are representative of the kinds of data regarding the laboratory which were obtained from the interviews.

The use of naturalistic research to gather the needed data has a firm theoretical foundation. Speaking to the NARST in 1981, Welch (1981) suggested that the spectrum of science education research should include a model which "focuses on description and interpretation rather than on measurement and prediction". Such a research model does not impose external constraints upon the system being studied. Welch referred to this type of research as naturalistic and described it as "a situation without manipulation, and with minimum imposition or constraints. It involves observation and interviews. . .or other nonintrusive measures."

THE DATA

The following exchange between JC and the interviewer--who had no control of any kind on the students nor their grades--will give an indication of types of information found. The class was studying electricity.

I: How do you feel about laboratory work we do?

JC: I like it.

I. Why do you like it?

JC: You get a chance to participate with your group.

I: What do you gain from that participation?

JC: Like when we hooked up all the circuits we. . .before hooking up all those circuits, I don't know if I would have known parallel and everything, so you learn certain aspects.

I: Do you like doing that?

JC: Yes. It makes you think about what's happening. You're doing this and you're not sure what's happening and you kind of, maybe think how can this happen. Like on the rubber rods. If we would have been out there testing it, you say well, there has to be something happening. It makes you think about stuff.

I: Let's go back to circuits, there you had an experience in the laboratory. Suppose I had given you a book to read that told you all about circuits and then, you went into the lab and set them up. How would you feel about that?

JC: Told us about parallel and everything?

I: Yes.

JC: I don't know if I could get. . .I don't know.

JC isolated what we feel is the indication of a significant attitude when he said, "It makes you think what's happening." Perhaps students feel that their learning is more their own if they have an experience that makes them think about what is happening. Consider the following dialogue about studying physics.

I: Sometimes you go to the laboratory and gather your data. Do you have any preferences among going to the laboratory to gather data, watching films or tapes, reading or listening to the teachers?

BE: I think going to the laboratory is one of the best.

I: Why?

BE: You can always remember back and doing something helps you remember the data better. I prefer the labs in physics.

BE is saying that "doing something" helps him remember better. The laboratory to BE represents that "doing something".

The physics students in the research completed more learning cycles than those in the seven experiments done as part of the research. That event gave us the opportunity to lead the students to draw comparison between a learning cycle not in the research and the activities experienced as part of the research. The students did a learning cycle on vectors--not a part of the research--after they completed the work on motion--in which they were given data--which was a part of the research. The student interviews revealed candid student opinions relative to the importance of and student beliefs about the laboratory.

I: Which investigation, motion or vectors, did you like better?

DM: Vectors.

I: Why?

DM: It was more interesting.

I: Did you do anything in the investigation of vectors that made it more interesting than the speed and acceleration investigation?

DM: The lab.

I: Does the lab help?

DM: Yeah, it helps you see and understand better. You can see what you are doing.

I: Specifically, how did that help you?

DM: Gave me an opportunity to, well, instead of just seeing the teacher do it up on the board and just say this is how it is, it gave us a chance to experiment with it and think about why.

I: And that helps?

DM: Yeah.

A second student, CH, was asked the same question regarding the investigations of motion and vectors. CH responded:

CH: I liked the vectors better.

I: Tell me why you liked the vectors better.

CH: We did an experiment.

I: How did you like that?

CH: That was good. I didn't really understand what was meant by magnitude until I saw it. . .until I did it.

The naturalistic data collected during the research regarding students' attitude toward laboratory is probably best summed up by the following, somewhat inarticulate statement of GC, but it expresses what we believe to be consensus of those students interviewed.

I: In some of the experimental work you've done this year in physics you've gone into the lab. At other times, the teacher has demonstrated. Do you have a preference?

GC: I don't know. I like to go into the lab because it's important for me to know how to do the procedures. You know. . .in the future, I'm sure it won't be the case that there is going to be someone there telling me exactly what to do. . .and I'll be the one to perform the experiment. . . When you're in the lab and you have a group, the data aren't. . .they're accurate, but they're not interpreted in the way that we need them at the right time. . .We go back into the group and we interpret the data later. . .

usually it's better for me to try to do the experiment. . .it helps me to understand what's going on. . .

I: How does it do that?. . .What are other reasons?

GC: It can hold my attention to the subject longer than if there are 20 people in the classroom and she is up in front and we're taking notes . . .It's a lot better for me to participate actively.

Much additional naturalistic-interview data which support the laboratory are available from the research and will be a part of the presentation. What has been included here provides the tenor that says that students like and believe in the laboratory. They feel they achieve more using the laboratory than through any other instructional procedure.

CONCLUSIONS

The naturalistic data from the interviews demonstrated that students are enthusiastic about what they learn and how they learn in the laboratory. They believe that learning in the laboratory is superior to other procedures used to supply them data which included watching a "live" teacher demonstration or one on video tape, being presented data someone else has gathered, being lectured to or reading a textbook.

That finding regarding the laboratory communicates a strong message to physics teachers--the laboratory is essential if physics is to be experienced as science. We postulate that the findings of this research are applicable to all of science teaching from kindergarten through grade twelve and possibly through college.

REFERENCE

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